Patents by Inventor Charles Lieber

Charles Lieber has filed for patents to protect the following inventions. This listing includes patent applications that are pending as well as patents that have already been granted by the United States Patent and Trademark Office (USPTO).

TRANSITION METAL OXIDE NANOWIRES

Publication number: 20080003839
Abstract: Nanowires are disclosed which comprise transition metal oxides. The transition metal oxides may include oxides of group II, group III, group IV and lanthanide metals. Also disclosed are methods for making nanowires which comprise injecting decomposition agents into a solution comprising solvents and metallic alkoxide or metallic salt precursors.
Type: Application
Filed: June 19, 2007
Publication date: January 3, 2008
Inventors: Hongkun Park, Charles Lieber, Jeffrey Urban, Qian Gu, Wan Yun

Nanoscale wires and related devices

Publication number: 20070281156
Abstract: The present invention relates generally to sub-microelectronic circuitry, and more particularly to nanometer-scale articles, including nanoscale wires which can be selectively doped at various locations and at various levels. In some cases, the articles may be single crystals. The nanoscale wires can be doped, for example, differentially along their length, or radially, and either in terms of identity of dopant, concentration of dopant, or both. This may be used to provide both n-type and p-type conductivity in a single item, or in different items in close proximity to each other, such as in a crossbar array. The fabrication and growth of such articles is described, and the arrangement of such articles to fabricate electronic, optoelectronic, or spintronic devices and components.
Type: Application
Filed: March 21, 2006
Publication date: December 6, 2007
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Xiangfeng Duan, Yi Cui, Yu Huang, Mark Gudiksen, Lincoln Lauhon, Jianfang Wang, Hongkun Park, Qingqiao Wei, Wenjie Liang, David Smith, Deli Wang, Zhaohui Zhong

NANOSCOPIC WIRE-BASED DEVICES AND ARRAYS

Publication number: 20070272951
Abstract: Electrical devices comprised of nanoscopic wires are described, along with methods of their manufacture and use. The nanoscopic wires can be nanotubes, preferably single-walled carbon nanotubes. They can be arranged in crossbar arrays using chemically patterned surfaces for direction, via chemical vapor deposition. Chemical vapor deposition also can be used to form nanotubes in arrays in the presence of directing electric fields, optionally in combination with self-assembled monolayer patterns. Bistable devices are described.
Type: Application
Filed: August 6, 2007
Publication date: November 29, 2007
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Thomas Rueckes, Ernesto Joselevich, Kevin Kim

Nanosensors

Publication number: 20070264623
Abstract: The present invention generally relates to nanoscale wires for use in determining analytes suspected to be present in a sample, especially in connection with determining information about a sample containing, or suspected of containing, two or more analytes. For example, the invention can involve a competitive, uncompetitive, or non-competitive binding assay including a nanoscale wire to a sample containing a species able to interact with the retain entity to produce a product, where the sample also contains or is suspected of containing a second species able to interact with the reaction entity to prevent production of the product resulting from interaction of the first species and the reaction entity. Based upon determination of production of the product, determination of the second species in the sample can be made.
Type: Application
Filed: June 15, 2005
Publication date: November 15, 2007
Applicant: PRESIDENT AND FELLOWS OF HARVARD COLLEGE
Inventors: Wayne Wang, Chuo Chen, Keng-Hui Lin, Ying Fang, Charles Lieber

500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers. Such a semiconductor may comprise an interior core comprising a first semiconductor; and an exterior shell comprising a different material than the first semiconductor. Such a semiconductor may be elongated and may have, at any point along a longitudinal section of such a semiconductor, a ratio of the length of the section to a longest width is greater than 4:1, or greater than 10:1, or greater than 100:1, or even greater than 1000:1.
Type: Application
Filed: July 2, 2007
Publication date: November 1, 2007
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Yi Cui, Xiangfeng Duan, Yu Huang

Nanoscopic wired-based devices and arrays
Publication number: 20070161237
Abstract: Electrical devices comprised of nanoscopic wires are described, along with methods of their manufacture and use. The nanoscopic wires can be nanotubes, preferably single-walled carbon nanotubes. They can be arranged in crossbar arrays using chemically patterned surfaces for direction, via chemical vapor deposition. Chemical vapor deposition also can be used to form nanotubes in arrays in the presence of directing electric fields, optionally in combination with self-assembled monolayer patterns. Bistable devices are described.
Type: Application
Filed: September 29, 2006
Publication date: July 12, 2007
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Thomas Rueckes, Ernesto Joselevich, Kevin Kim

Nanosensors
Publication number: 20070158766
Abstract: Electrical devices comprised of nanowires are described, along with methods of their manufacture and use. The nanowires can be nanotubes and nanowires. The surface of the nanowires may be selectively functionalized. Nanodetector devices are described.
Type: Application
Filed: October 17, 2006
Publication date: July 12, 2007
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Hongkun Park, Qingqiao Wei, Yi Cui, Wenjie Liang

Doped elongated semiconductors, growing such semiconductors, devices including such semiconductors, and fabricating such devices
Publication number: 20070048492
Abstract: A bulk-doped semiconductor that is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers. Such a semiconductor may comprise an interior core comprising a first semiconductor; and an exterior shell comprising a different material than the first semiconductor. Such a semiconductor may be elongated and may have, at any point along a longitudinal section of such a semiconductor, a ratio of the length of the section to a longest width is greater than 4:1, or greater than 10:1, or greater than 100:1, or even greater than 1000:1.
Type: Application
Filed: October 4, 2006
Publication date: March 1, 2007
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Yi Cui, Xiangfeng Duan, Yu Huang

Nanoscopic wired-based devices and arrays
Publication number: 20070045667
Abstract: Electrical devices comprised of nanoscopic wires are described, along with methods of their manufacture and use. The nanoscopic wires can be nanotubes, preferably single-walled carbon nanotubes. They can be arranged in crossbar arrays using chemically patterned surfaces for direction, via chemical vapor deposition. Chemical vapor deposition also can be used to form nanotubes in arrays in the presence of directing electric fields, optionally in combination with self-assembled monolayer patterns. Bistable devices are described.
Type: Application
Filed: November 3, 2006
Publication date: March 1, 2007
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Thomas Rueckes, Ernesto Joselevich, Kevin Kim

500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest

width of less than 500 nanometers. Such a semiconductor may comprise an interior core comprising a first semiconductor; and an exterior shell comprising a different material than the first semiconductor. Such a semiconductor may be elongated and may have, at any point along a longitudinal section of such a semiconductor, a ratio of the length of the section to a longest width is greater than 4:1, or greater than 10:1, or greater than 100:1, or even greater than 1000:1.
Type: Application
Filed: October 4, 2006
Publication date: February 8, 2007
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Yi Cui, Xiangfeng Duan, Yu Huang

Doped elongated semiconductors, growing such semiconductors, devices including such semiconductors, and fabricating such devices

Publication number: 20070032051
Abstract: A bulk-doped semiconductor that is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers. Such a semiconductor may comprise an interior core comprising a first semiconductor; and an exterior shell comprising a different material than the first semiconductor. Such a semiconductor may be elongated and may have, at any point along a longitudinal section of such a semiconductor, a ratio of the length of the section to a longest width is greater than 4:1, or greater than 10:1, or greater than 100:1, or even greater than 1000:1.
Type: Application
Filed: October 4, 2006
Publication date: February 8, 2007
Applicant: President and fellows of Harvard College
Inventors: Charles Lieber, Yi Cui, Xiangfeng Duan, Yu Huang

Doped elongated semiconductors, growing such semiconductors, devices including such semiconductors, and fabricating such devices

Publication number: 20070032052
Abstract: A bulk-doped semiconductor that is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers. Such a semiconductor may comprise an interior core comprising a first semiconductor; and an exterior shell comprising a different material than the first semiconductor. Such a semiconductor may be elongated and may have, at any point along a longitudinal section of such a semiconductor, a ratio of the length of the section to a longest width is greater than 4:1, or greater than 10:1, or greater than 100:1, or even greater than 1000:1.
Type: Application
Filed: October 4, 2006
Publication date: February 8, 2007
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Yi Cui, Xiangfeng Duan, Yu Huang

Doped elongated semiconductors, growing such semiconductors, devices including such semiconductors, and fabricating such devices

Publication number: 20070026645
Abstract: A bulk-doped semiconductor that is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers. Such a semiconductor may comprise an interior core comprising a first semiconductor; and an exterior shell comprising a different material than the first semiconductor. Such a semiconductor may be elongated and may have, at any point along a longitudinal section of such a semiconductor, a ratio of the length of the section to a longest width is greater than 4:1, or greater than 10:1, or greater than 100:1, or even greater than 1000:1.
Type: Application
Filed: October 4, 2006
Publication date: February 1, 2007
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Yi Cui, Xiangfeng Duan, Yu Huang

Nanoscale sensors

Publication number: 20060269927
Abstract: Various aspects of the present invention generally relate to nanoscale wire devices and methods for use in determining analytes suspected to be present in a sample, and systems and methods of immobilizing entities such as reaction entities relative to nanoscale wires. In one aspect, a nucleic acid, such as DNA, may be immobilized relative to a nanoscale wire and, in some cases, grown from the nanoscale wire. In certain embodiments, the nucleic acid may interact with entities such as other nucleic acids, proteins, etc., and in some cases, such interactions may be

triphosphates in solution; additionally, various properties of the nucleic acid may be determined, for example, using electric field interactions between the nucleic acid and the nanoscale wire.
Type: Application
Filed: May 25, 2005
Publication date: November 30, 2006
Inventors: Charles Lieber, Fernando Patolsky, Gengfeng Zheng

Nanoscopic wire-based devices and arrays
Publication number: 20060237749
Abstract: Electrical devices comprised of nanoscopic wires are described, along with methods of their manufacture and use. The nanoscopic wires can be nanotubes, preferably single-walled carbon nanotubes. They can be arranged in crossbar arrays using chemically patterned surfaces for direction, via chemical vapor deposition. Chemical vapor deposition also can be used to form nanotubes in arrays in the presence of directing electric fields, optionally in combination with self-assembled monolayer patterns. Bistable devices are described.
Type: Application
Filed: November 21, 2005
Publication date: October 26, 2006
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Thomas Rueckes, Ernesto Joselevich, Kevin Kim

System and method for processing nanowires with holographic optical tweezers
Publication number: 20060240591
Abstract: A system and method for manipulating and processing nanowires in solution with arrays of holographic optical traps. The system and method of the present invention is capable of creating hundreds of individually controlled optical traps with the ability to manipulate objects in three dimensions. Individual nanowires with cross-sections as small as 20 nm and lengths exceeding 20 ?m are capable of being isolated, translated, rotated and deposited onto a substrate with holographic optical trap arrays under conditions where single traps have no discernible influence. Spatially localized photothermal and photochemical processes induced by the well-focused traps can also be used to melt localized domains on individual nanowires and to fuse nanowire junctions.
Type: Application
Filed: January 11, 2006
Publication date: October 26, 2006
Inventors: David Grier, Ritesh Agarwal, Guihua Yu, Charles Lieber, Kosta Ladavac, Yael Roichman

Nanoscopic wire-based devices and arrays
Publication number: 20060220067
Abstract: Electrical devices comprised of nanoscopic wires are described, along with methods of their manufacture and use. The nanoscopic wires can be nanotubes, preferably single-walled carbon nanotubes. They can be arranged in crossbar arrays using chemically patterned surfaces for direction, via chemical vapor deposition. Chemical vapor deposition also can be used to form nanotubes in arrays in the presence of directing electric fields, optionally in combination with self-assembled monolayer patterns. Bistable devices are described.
Type: Application
Filed: December 20, 2005
Publication date: October 5, 2006
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Thomas Rueckes, Ernesto Joselevich, Kevin Kim

Nanoscale wires and related devices
Publication number: 20060175601
Abstract: The present invention relates generally to sub-microelectronic circuitry, and more particularly to nanometer-scale articles, including nanoscale wires which can be selectively doped at various locations and at various levels. In some cases, the articles may be single crystals. The nanoscale wires can be doped, for example, differentially along their length, or radially, and either in terms of identity of dopant, concentration of dopant, or both. This may be used to provide both n-type and p-type conductivity in a single item, or in different items in close proximity to each other, such as in a crossbar array. The fabrication and growth of such articles is described, and the arrangement of such articles to fabricate electronic, optoelectronic, or spintronic devices and components.
Type: Application
Filed: June 30, 2005
Publication date: August 10, 2006
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Xiangfeng Duan, Yi Cui, Yu Huang, Mark Gudiksen, Lincoln Lauhon, Jianfang Wang, Hongkun Park, Qingqiao Wei, Wenjie Liang, David Smith, Deli Wang, Zhaohui Zhong

Array-based architecture for molecular electronics
Publication number: 20060161876
Abstract: An architecture for nanoscale electronics is disclosed. The architecture comprises arrays of crossed nanoscale wires having selectively programmable crosspoints. Nanoscale wires of one array are shared by other ... between the arrays. Nanoscale signal restoration elements are also provided, allowing an output of a first array to be used as an input to a second array. Signal restoration occurs

Publication date: July 20, 2006

Inventors: Andre DeHon, Charles Lieber

Nanosensors
Publication number: 20060054936
Abstract: Electrical devices comprised of nanowires are described, along with methods of their manufacture and use. The nanowires can be nanotubes and nanowires. The surface of the nanowires may be selectively functionalized. Nanodetector devices are described.
Type: Application
Filed: December 15, 2004
Publication date: March 16, 2006
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Hongkun Park, Qingqiao Wei, Yi Cui, Wenjie Liang

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Patents by Inventor Charles Lieber

Charles Lieber has filed for patents to protect the following inventions. This listing includes patent applications that are pending as well as patents that have already been granted by the United States Patent and Trademark Office (USPTO).

Nanoscale arrays, robust nanostructures, and related devices

Publication number: 20050253137
Abstract: The present invention relates generally to nanotechnology and sub-microelectronic circuitry, and more particularly to nanoelectronics. One aspect of the invention is directed to nanostructures on substrates. In some cases, the substrate may be or comprise glass and/or polymers, and in some cases, the substrate may be flexible and/or transparent. The present invention is also directed, according to another aspect, to techniques for fabricating nanostructures on substrates. For example, monolayers of nanoscale semiconductors may be etched, e.g. photolithographically, to yield discrete and/or predetermined arrays of nanoscale semiconductors and other articles on a substrate. In one embodiment, the array may include hundreds, thousands, or more of electronic components such as field-effect transistors. Such arrays may be connected to electrodes using photolithographic techniques, and in some cases, without the need for registering individual semiconductor-metal contacts.
Type: Application
Filed: November 22, 2004
Publication date: November 17, 2005
Applicant: President and Fellows of Harvard College
Inventors: Dongmok Whang, Song Jin, Yue Wu, Michael McAlpine, Robin Friedman, Charles Lieber

Doped elongated semiconductors, growing such semiconductors, devices including such semiconductors and fabricating such devices

Publication number: 20050164432
Abstract: A bulk-doped semiconductor that is at least one of the following: a single crystal, an elongated and bulk-doped semiconductor that, at any point along its longitudinal axis, has a largest cross-sectional dimension less than 500 nanometers, and a free-standing and bulk-doped semiconductor with at least one portion having a smallest width of less than 500 nanometers. Such a semiconductor may comprise an interior core comprising a first semiconductor; and an exterior shell comprising a different material than the first semiconductor. Such a semiconductor may be elongated and my have, at any point along a longitudinal section of such a semiconductor, a ratio of the length of the section to a longest width is greater than 4:1, or greater than 10:1, or greater than 100:1, or even greater than 1000:1.
Type: Application
Filed: March 17, 2005
Publication date: July 28, 2005
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Yi Cui, Xiangfeng Duan, Yu Huang

Nanoscopic wire-based devices and arrays

Publication number: 20050117441
Abstract: Electrical devices comprised of nanoscopic wires are described, along with methods of their manufacture and use. The nanoscopic wires can be nanotubes, preferably single-walled carbon nanotubes. They can be arranged in crossbar arrays using chemically patterned surfaces for direction, via chemical vapor deposition. Chemical vapor deposition also can be used to form nanotubes in arrays in the presence of directing electric fields, optionally in combination with self-assembled monolayer patterns. Bistable devices are described.
Type: Application
Filed: October 26, 2004
Publication date: June 2, 2005
Applicant: President and Fellows of Harvard College
Inventors: Charles Lieber, Thomas Rueckes, Ernesto Joselevich, Kevin Kim

Transition metal oxide nanowires

Publication number: 20050064731
Abstract: Nanowires are disclosed which comprise transition metal oxides. The transition metal oxides may include oxides of group II, group III, group IV and lanthanide metals. Also disclosed are methods for making nanowires which comprise injecting decomposition agents into a solution comprising solvents and metallic alkoxide or metallic salt precursors.
Type: Application
Filed: July 22, 2002
Publication date: March 24, 2005
Inventors: Hongkun Park, Charles Lieber, Jeffrey Urban, Qian Gu, Wan Yun

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